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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 065632

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

Digital Computer
~~CONSOLE~~ OPERATOR (clerical) 1-25.17

B-565 S-286

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U. S. Employment Service
in Cooperation with
California and Wisconsin State Employment Services

August 1964

(Revised)

GATB # 2518
2466

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

CONSOLE OPERATOR (clerical) 1-25.17

B-565

Summary

The General Aptitude Test Battery was administered to two samples of Console Operators 1-25.17 for the purpose of validating and cross-validating occupational norms. The date of criterion data collection, criterion type and the number (N) in each final sample are shown below:

Sample	Year	Criterion	N
Validation (Wisconsin)	1962-63	Supervisory ratings	77
Cross-Validation (California)	1962-64	Supervisory ratings	67

GATB Norms for Console Operator 1-25.17, B-565.

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-I CB-1-J	115	G	Part 3 Part 4 Part 6	110
V	CB-1-J	95	V	Part 4	95
N	CB-1-D CB-1-I	105	N	Part 2 Part 6	100

Effectiveness of Norms

Validation Sample

The data in Table IV-A indicate that only 66 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms 86 percent would have been good workers. 34 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 14 percent would have been poor workers.

Cross-Validation Sample

The data in Table IV-B indicate that only 66 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms 88 percent would have been good workers. 34 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 12 percent would have been poor workers.

TECHNICAL REPORT

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Console Operator 1-25.17.

II. Sample

Validation Sample - Wisconsin

The GATB, B-1002B, was administered during the period April 1962 - July 1963 to 9 women and 68 men employed as Console Operators 1-25.17 at the following companies affiliated with the Data Processing Management Association in Milwaukee, Wisconsin:

Allis Chalmers Mfg. Co.
Badger Mutual Insurance Co.
Heil Corporation
Harnishchfager Corp.
Marine National Bank
Marshall-Ilsley Bank
George Meyer Mfg. Co.
Miller Brewing Co.
Milwaukee Gas-Light Co.
Mobile Oil Company
Northwestern Mutual Life Ins. Co.
Schlitz Brewing Co.
A. O. Smith Corporation
Square D
West Bend Aluminum Co.
Wisconsin Telephone Co.

All workers in this sample have received IBM school training or company on-the-job training and are considered experienced. Workers who are trained at the IBM school must pass the IBM Data Processing Machine Operator Aptitude Test with a minimum score of 15. Some of the workers have been promoted from Tabulating Machine Operator, Tape Handler or Assistant Console Operator.

TABLE I

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

Validation Sample (Wisconsin)

N = 77	M	σ	Range	r
Age (years)	29.4	7.8	19-55	.252*
Education (years)	12.6	1.2	11-16	.211
Experience (months)	38.8	51.3	1-360	.023

*Significant at the .05 level

Cross-Validation Sample - California

During the period March 28, 1962 through February 27, 1964, the General Aptitude Test Battery, B-1002B, was administered to 62 male and 5 female Console Operators employed by various organizations in California. The names and locations of the participating organizations are as follows:

Aerojet General Corp.	Azusa
Aerospace Corp.	Los Angeles
Bank of America	San Francisco
Jet Propulsion Laboratories	Pasadena
Pacific Telephone and Telegraph Company	Los Angeles
Rand Corp.	Santa Monica
Systems Development Corp.	Santa Monica

Five of the participating organizations require job applicants to prepare a standard employment form, be screened by a personnel department interviewer, and be interviewed by a supervisor in the computing department prior to employment. Two organizations have been able to confine selection to upgrading and/or transferring employees having related job experience.

All of the above organizations require potential employees to have a high school education, but none of these organizations have any fixed age requirements. The IBM Data Processing Machine Operator Aptitude Test is used by 2 of the above organizations in the hiring process, while another organization uses a specially designed verbal and symbolic aptitude test in selection.

The principal method of training used by all 7 participating organizations is on-the-job training under close supervision. Five months is considered the minimum on-the-job training period for a worker to reach satisfactory production. All workers in the sample were performing comparable work and were considered experienced.

TABLE II-B

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

N = 67	M	σ	Range	r
Age (years)	26.6	5.2	19-40	-.014
Education (years)	12.8	1.1	11-16	-.284*
Experience (months)	29.3	24.7	5-108	.150

*Significant at the .05 level

III. Job Description

Job Title: Console Operator (clerical) 1-25.17

Job Summary: Sets up, monitors, and controls operation of electronic computer and a series of other data processing equipment that automatically process commerical and business data by operating central control unit known as a console.

Work Performed: Receives work order: Studies program instruction sheet to determine equipment setup and operating instructions. Places work order in time clock to record time machine processing was started.

Loads high-speed-printing machine that converts data into printed records: Flips out four paper guides, with fingers. Positions paper in guides, fitting guide holes on edges of paper in sprockets of sprocket chain. Flips paper guides over inserted paper. Turns knobs and pulls levers to adjust horizontal and vertical printing positions, tension, density, and evenness of print. Selects and positions appropriate carriage tape on sprocket wheels to set spacing of paper. Depresses carriage-restore button to move carriage to beginning of tape.

Loads magnetic-tape unit: Mounts reels of magnetic tape on spindles of magnetic-tape unit, which extracts input data or records output data. Feeds tape, with fingers, around take-up spools and over read-write head. Wraps tape around empty reel, with fingers, turning reel approximately seven times from reflector-spot location, to hold tape in place. Turns knobs on reel to hold reel in place. Turns select-light dial to identify magnetic tape unit being operated. Depresses re-set, load, rewind, and start buttons to ready machine.

Loads card-read-punch machine: Obtains punched program cards from tape librarian and places stack of cards in read hopper of machine. Places card weight on top of stack to facilitate feeding of cards into machine. Pushes start and re-set buttons on console and load-button reader to start machine. Manipulates control switches on console panel to start and operate electronic computer that automatically senses and processes data: Flips switches to activate specific magnetic tape units to sense or to print information on tape. Types instructions in machine language code, from written instructions or from own knowledge, using typewriter connected to console. Depresses request button on console to automatically receive specific information in typed form from computer.

Monitors operation of computer and related equipment: Observes lights on console board and reads information typed by automatic typewriter to monitor electronic-data-processing system and to determine point of equipment failure. Manipulates controls in accordance with standard procedures to rearrange sequence of program steps in order to correct computational errors or to continue operation when individual units of system malfunction. Notifies supervisor when problem cannot be solved by manipulation of control switches. Unloads equipment at completion of processing: Pushes re-set button and unload button on magnetic tape unit to remove

reel of tape from unit. Removes red ring in groove on reel to indicate that recorded information is to be used at later date and is not to be erased. Removes cards from pockets of card-read-punch machine and stores cards in appropriate drawers. Removes printed forms from high-speed printer by ripping at perforations and carries forms to operator of bursting machine for separation. Places work order in time clock to record time machine processing was completed.

Prepares reports and keeps adequate recores on (1) errors that require change of instruction or sequence of operation, (2) time and number of insertions in sequence of operation, (3) time and number of insertions or deletions of information; also prepares production reports. May maintain inventory of forms and supplies used in computer operation.

IV. Experimental Battery

All of the tests of the GATB, B-1002B, were administered to the validation and cross-validation groups.

V. Criterion

Validation Sample (Wisconsin)

The criterion data were collected during the period April 1962 through July 1963 and consisted of two sets of independent ratings made by the first-line supervisor on USES Form SP-21, "Descriptive Rating Scale." A period of at least two weeks elapsed between the first and second ratings. The rating scale consisted of nine items covering different aspects of job performance, with five alternatives for each item. Weights of one through five, indicating the degree of job proficiency attained, were assigned to the alternatives. A reliability coefficient of .92 was obtained for the criterion. Therefore, the two sets of ratings were combined, resulting in a distribution of final criterion scores of 42-86 with a mean of 67.7 and a standard deviation of 8.6.

Cross-Validation Sample (California)

The criterion data were collected during the period May 1962 through March 1964 and consisted of two sets of independent ratings made by the first-line supervisor on USES Form SP-21, "Descriptive Rating Scale." A period of at least two weeks elapsed between the first and second ratings. The rating scale consisted of nine items covering different aspects of job performance, with five alternatives for each item. Weights of one through five, indicating the degree of job proficiency attained, were assigned to the alternatives. A reliability coefficient of .93 was obtained for the criterion. Therefore, the two sets of ratings were combined, resulting in a distribution of final criterion scores of 34-90 with a mean of 64.0 and a standard deviation of 11.8.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in this occupation:

Intelligence (G) - required to learn computer operating procedures and techniques, to apply them to the problem to be solved and to acquire a general knowledge of programs.

Verbal Aptitude (V) - required to comprehend programming instructions and to prepare operating records and reports.

Numerical Aptitude (N) - required to calculate operating time and equipment and operators needed to solve a problem.

Clerical Perception (Q) - required to detect errors in program instructions and to maintain accurate records and reports of machine performance and production.

Manual Dexterity (M) - required to set up processing equipment, manipulate switches, control knobs and levers, and to handle decks of cards.

B. Quantitative Analysis: Validation Sample - Wisconsin

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 77

Aptitudes	M	σ	r
G-Intelligence	117.3	15.2	.549**
V-Verbal Aptitude	109.3	13.4	.450**
N-Numerical Aptitude	118.0	15.7	.423**
S-Spatial Aptitude	115.7	17.9	.307**
P-Form Perception	116.3	17.7	.175
Q-Clerical Perception	120.3	13.1	.276*
K-Motor Coordination	111.6	16.9	-.014
F-Finger Dexterity	106.0	22.4	.085
M-Manual Dexterity	113.2	26.5	.054

*Significant at the .05 level
**Significant at the .01 level

C. Selection of Test Norms: Validation Sample - Wisconsin

TABLE III

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X	X	X			X			X
Irrelevant									
Relatively High Mean	X		X			X			
Relatively Low Sigma		X				X			
Significant Correlation with Criterion	X	X	X	X		X			
Aptitudes to be Considered for Trial Norms	G	V	N	S		Q			

Trial norms consisting of various combinations of Aptitudes G, V, N, S and Q with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of G-110, V-95 and N-100 had the best selective efficiency.

VII. Validity of Norms (Concurrent)

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 34 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV-A shows the relationship between test norms consisting of Aptitudes G, V, and N with critical scores of 110, 95 and 100, respectively, and the dichotomized criterion for the validation sample (Wisconsin). Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV-A

Validity of Test Norms for Console Operator 1-25.17
(G-110, V-95, N-100)

Validation Sample (Wisconsin)

N = 77	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	7	44	51
Poor Workers	19	7	26
Total	26	51	77

Phi Coefficient = .59
X^2 = 27.181
P/2 < .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

Table IV-B shows the relationship between test norms consisting of Aptitudes G, V and N with critical scores of 110, 95 and 100, respectively, and the dichotomized criterion for the cross-validation sample (California). Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV-B

Validity of Test Norms for Console Operator 1-25.17
(G-110, V-95, N-100)

Cross-Validation Sample (California)

N = 67	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	35	44
Poor Workers	18	5	23
Total	27	40	67

Phi Coefficient = .560
X^2 = 21.011
P/2 < .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes G, V and N with minimum scores of 110, 95 and 100, respectively, have been established as B-1002 norms for Console Operator 1-25.17. The equivalent B-1001 norms consist of G-115, V-95 and N-105.

IX. Determination of Occupational Aptitude Pattern

The data for this study met the requirements for incorporating the occupation studied into OAP-7 which is shown in Section II of the Guide to the Use of the General Aptitude Test Battery, January 1962.